EOD TEST PROCEDURE

TP 115A	
Title	**Page Number**
Distillation Analysis of Petroleum Fuels	1 of 21
Originator	**Supersedes**
Carl A. Scarbro	TP 115
Responsible Organization	**Computer Program**
Fuels and Chemical Analysis Branch (FCAB)	
Type of Test Report	**Data Form Number**
Instrument Generated Report	Form 115-01
Report Distribution	**Implementation Date**
Project Officer and Chem Lab File	09-30-94

Implementation Approval

Original Test Procedure authorized by EPCN# 145 on 03-21-94

Revision Description

(1) 09-30-94 The purpose of this change is to revise the procedure as described in EPCN #170.

Note: Specific brand names in EPA/EOD procedures are for reference only and are not an endorsement of those products.

Table of Contents

Attachments

1. Purpose

This method is the Engineering Operations Division (EOD) specific version of American Society for Testing and Materials' (ASTM) D 86-90, "The Standard Test Method for the Distillation of Petroleum Products," a method quoted in EOD fuel procurement, federal vehicle emission, and fuels enforcement test programs (calculation of cetane index).

The method is suitable for natural gasolines, motor gasolines, aviation turbine fuels, special boiling point spirits, naphthas, white spirits, kerosines, gas oils, distillate fuel oils, and similar petroleum products.

2. Test Article Description

Petroleum product sample of 100 mL in volume

3. References

3.1 Code of Federal Regulations, Title 40, Part 86, Subpart B, Section 86.113

3.2 ASTM Standard Method D 86-90 Standard Test Method for the Distillation of Petroleum Products

3.3 ASTM Standard Practice E 177-86, Standard Practice for Use of the Terms Precision and Bias in ASTM Test Methods

3.4 ASTM Manual MNL 7, Manual on Presentation of Data and Control Chart Analysis: 6th Edition

3.5 Precision Instruction Manual TS-74000 AW-6

3.6 Herzog Operation Instructions, Electronic, MP 626

4. Required Equipment

4.1 Automatic distillation apparatus

Equipment used: Precision Scientific ADA III with ADA IV software
Herzog MP 626

4.2 Fume hood

4.3 Glassware

4.3.1 100-mL receiver specific for each instrument

4.3.2 125-mL side arm boiling flask

4.4 Disposable droppers

4.5 Rinse bottles for glassware cleaning

4.6 Boiling granules, Boileezers® or equivalent [1344-28-1]

4.7 Constant temperature bath

4.8 Reagents ("reagent grade" or better, or as otherwise specified)

4.8.1 N-Pentane [109-66-0], commercial grade

4.8.2 Sodium sulfate, anhydrous [7757-82-6], mp 884 °C

4.8.3 Toluene [108-88-3], bp 109.6-116.6 °C

4.8.4 Control Gasoline substantially similar to the emission certification test gasoline specified in 40 CFR 86.113

4.8.5 Control Diesel Fuel substantially similar to the emission certification #2 diesel specified in 40 CFR 86.113

4.8.6 Micro Liquid Laboratory Cleaner, or equivalent

4.9 Form 115-01, Instrument Fuel Type Tally Sheet, (Attachment A)

4.10 Form 109-01, Control Chart for the Range of Duplicate Analyses (see TP 109)

4.11 Form 109-02, Control Chart for Individual Observations (see TP 109)

4.12 Form 109-03, Chain of Custody (see TP 109)

4.13 Form EPA 3500-5

5. Precautions

5.1 N-pentane, gasoline, and toluene are hazardous materials. Specific procedures for handling these materials are listed in their respective Material Safety Data Sheets (MSDS) on file in Fuels and Chemistry Analysis Branch (FCAB).

The analyst must be familiar with these MSDS procedures prior to performing this procedure.

5.2 Automatic distillation apparatuses (ADA) apply heat to flammable liquids in excess of the flash points of those liquids. The possibility of fire is present when using this test method.

Automatic fire protection equipment must be installed and in working order before use.

Dispose of and do not use any glassware which has cracks in the coke layer or in the glass itself.

Dispose of and do not use any boiling flask that has any brownish residue coating an area greater than 50% of its spherical section.

Flask failure is the chief cause of ADA fires.

5.3 In case of a spill of one gallon or more of any of the above reagents or samples, remove all personnel from the area, contact the Emergency Response Team and, if possible, turn the equipment off.

Spills of a gallon or less can be mopped up with spill control pillows or absorbent found near either instrument.

Contact the safety office regarding appropriate disposal.

5.4 Samples, standards, resistance temperature devices (RTD), flask supports, and glassware must be at the prescribed test temperatures for their fuel group to ensure accuracy.

6. Visual Inspection

6.1 Samples are inspected before analysis for phase separation, leaks, and tampering.

6.2 Before analysis, the fire suppression bottle is examined for adequate CO_2 supply pressure (500 psig).

The ADA III must have CO_2 delivery pressure set at 200 psig and the MP 626 must have CO_2 delivery pressure set between 40 and 60 psig for their respective fire suppression systems.

6.3 Before use, glassware is inspected for cracks, excess residue, and contamination.

7. Test Article Preparation

7.1 Check and, if necessary, reset the internal clocks on both instruments for the correct date and time.

7.2 Verify and, if necessary, readjust the barometers for both instruments per their respective instruction manuals so that they are within 3 mm of Hg of a temperature- and latitude-corrected mercury barometer.

7.3 Verify and, if necessary, readjust the receiver zero volume set points for both instruments, per their respective instruction manuals, once a week or when a new receiver is used.

Receivers are specific to each instrument and must not be used interchangeably.

7.4 Refer to Form 115-01 to determine which quality control samples need to be analyzed with the current sample batch.

7.4.1 Provide for at least one analysis of toluene per week per instrument whenever this method is being performed. Toluene should be analyzed prior to the analysis of other samples.

7.4.2 Provide for at least one laboratory duplicate.

If the number of samples exceeds 20, at least one laboratory duplicate must be analyzed for every 20 samples.

7.4.3 A control gasoline or control diesel fuel must be analyzed at least once for every 20 samples per fuel type, per instrument.

7.5 Obtain and inspect samples as described in the FCAB Enforcement Sample Chain-of-Custody Procedure.

7.6 Refer to Attachment B to identify the test conditions for the fuel groups to be tested.

Prepare the sample and either the ADA III or the MP 626 to meet the conditions specified.

Bring the temperature of the receiver, the boiling flask, the temperature sensor, the receiver compartment, condenser, and the sample to the indicated temperatures.

Samples, flasks, receivers, and the RTD must be chilled to between 55 °F and 65 °F for Fuel Groups 1 through 3. Samples are placed in a constant temperature bath set at 60 °F for one hour prior to analysis.

Flasks, receivers, and the RTD are chilled for 20 minutes in either a refrigerator set at 60 °F or in the receiver compartment of ADA III.

8. Test Procedure

101 Using a piece of soft, lint-free absorbent material attached to a cord, swab out the condenser tube on the instrument so that no liquid is visible on its interior surface.

102 Pour the sample into the receiver flask and fill it to the 100-mL mark. Transfer the contents of the receiver as completely as practical to the boiling flask, taking care not to spill or lose any liquid through the side arm.

Do not attempt to dry the receiver flask.

If the flask's bottom does not have a residue covering an area approximately equal to the hole in the flask support used, add 6 to 10 boiling granules.

103 Fit the temperature sensor (RTD) tightly into the neck of the boiling flask with a silicone stopper. Locate the sensor in relationship to the side arm as prescribed by the instrument and RTD manufacturer.

104 Fit the boiling flask's side arm into the condenser tube with a silicone stopper.

Adjust the flask in a vertical position with the side arm extending 1 to 2 inches into the condenser.

Raise and adjust the flask support to fit snugly against the bottom of the flask.

105 Place the receiver used to measure the sample charge into the receiver compartment under the lower end of the condenser tube.

The condenser tube must extend at least 1 inch into the receiver but not below the 100-mL mark.

Cover the receiver closely with the gasket found on both instruments.

106 Using the program appropriate to the instrument and sample (see Attachment C), begin the test . The program selected must provide results meeting the analysis conditions outlined in Attachment B.

Perform Steps 101 through 106 as quickly as possible to minimize changes in starting temperatures and changes in the sample's composition due to evaporation.

107 After the instrument has measured the end point, the instrument will cool the boiling flask and request the residue of the distillation.

With a disposable dropper, pour or transfer the residue to a 5-mL graduate and measure the volume.

Enter that volume into the instrument as the residue. The instrument will finish the necessary calculations and corrections.

108 Verify the following results on the instrument output:

"Cor Loss" is within 1 mL of the "Expected Loss" for the ADA III.

"Pressure Corr. Recovery" - 5.0 is within 1 mL of the "Final Heat Adjustment Pt." on the MP 626.

If the results are not within the above limits, an accurate determination of the time from the 5-mL residue point to the end point can not be made.

Discard the test results and reanalyze the sample.

109 ADA III: Convert the time recorded in minutes as "Min From FH To End PT" to seconds. Compare the result with the "Time from 5 mL Residue to End Point" specification found in Attachment B for the fuel group analyzed.

If it does not meet the specification, discard the test printout and reanalyze the sample.

MP 626: Sum the times recorded in seconds at the bottom of the column labeled "Dist. Rate" on the output.

Compare the result with the "Time from 5 mL Residue to End Point" specification, found in Attachment B, for the fuel group analyzed.

If it does not meet the specification, delete the test from the MP 626 database, discard any hard copy of the test, and reanalyze the sample.

110 Review the instrument output to verify the balance of the acceptance criteria. Repeat any distillation that did not meet the conditions specified in Attachment B.

Multiple analyses are often necessary for gasolines.

The analyst initials the output if all the acceptance criteria are met.

Note: Difficulty in achieving a valid test is related to the volatility and composition of the material being tested. Initially the analyst must identify any unknown by fuel type and, if it is a gasoline, its expected vapor pressure.

Appropriate programs for different fuels are listed in Attachment C. These programs may need to be modified on an ad-hoc basis to achieve an in-specification analysis.

Instrument-specific guidelines for modifying distillation programs may be found in Attachment D.

111 On Form 115-01, enter an "X" for the fuel type of each successful analysis. This is done to maintain a count of the number of samples of each type that have been analyzed, in order to determine when quality control samples should be run.

112 Rinse the boiling flask with sample collected in the receiver.

Pour the rinse into an appropriate product drain can.

Rinse the flask with n-Pentane, drain it into a container for gasoline only, and air dry.

Do not try to remove the coke from the bottom of the boiling flask.

113 Rinse the receiver with n-Pentane and drain it into a container for gasoline only.

Air dry the receiver.

If residues are present after drying, clean with a suitable glass cleaning detergent such as Micro Liquid Laboratory Cleaner, rinse with hot water, and air dry.

114 Analyze toluene for the weekly calibration verification at least once a week if any analyses are performed during that week.

Use the specific program for toluene described in Attachment C. This measurement is to be made with the "D 1078" option selected on the ADA.

On Form 109-02, record the date and result specific for Toluene and the instrument utilized.

Calculate the moving range and plot both the result and the moving range values.

Review the control chart for out-of-control indications.

Out-of-control indications require immediate corrective action. Corrective action must include reestablishment of process control, and reanalysis of samples if they were affected by the out-of-control indication.

On the control chart, record the results of the investigation and the corrective action taken.

115 Analyze a Control Diesel Fuel or Control Gasoline using the corresponding programs found in Attachment C. The choice of diesel fuel or gasoline is based on a frequency of at least once for every 20 analyses per fuel type, per instrument, as indicated by Form 115-01.

On Form 109-02, record the date and the result for the 10% , 50%, and 90% recovered levels specific to the fuel type and data point.

Calculate the moving range and plot both the result and the moving range values.

Review the control chart for out-of-control indications.

Out-of-control indications require immediate corrective action. Corrective action must include re-establishment of process control, and reanalysis of samples if they were affected by the out-of-control indication.

On the control chart, record the results of the investigation and the corrective action taken.

116 At least one in every twenty analyses must be run as a laboratory duplicate. The duplicate must be run on the same instrument as the initial analysis.

On Form 109-01, record laboratory duplicate values for the 10% , 50%, and 90% recovered levels, as they become available, corresponding to that instrument and fuel type.

Calculate and plot the range. Review the control chart for out-of-control indications.

Out-of-control indications require immediate corrective action. Corrective action must include re-establishment of process control, and reanalysis of samples if they were affected by the out-of-control indication.

On the control chart, record the results of the investigation and the corrective action taken.

9. Data Input

9.1 The test date, test time, and barometer are automatically recorded by the instrument.

The analyst enters the Sample ID and the heating program into the instrument. At the end of the test, the analyst enters the residue in milliliters.

9.2 Laboratory duplicate results are recorded on Form 109-01.

9.3 Individual control charts (Form 109-02) are used to record Control Diesel Fuel, Control Gasoline, and toluene results.

9.4 Each completed analysis is tallied by fuel type on Form 115-01.

10. Data Analysis

10.1 The analyst reviews the ADA output for reasonableness, completeness, and conformance to the acceptance criteria.

Fuel Group 1 products (gasolines) or any material having a percent loss of greater than 2.0 percent must be reported as percent evaporated.

10.2 A verifying technician reviews the ADA output to confirm compliance with the acceptance criteria.

10.3 The verifying technician signs and dates the ADA output, indicating the validation has been completed.

11. Data Output

The instrument outputs (Attachment C, Form 115-01, and Control Chart Forms 109-01 and 109-02) are filed according to FCAB Enforcement Sample Chain-of-Custody Procedure.

12. Acceptance Criteria

12.1 Instrument barometer must be within 3 mm of Hg of a temperature- and latitude-corrected mercury barometer.

12.2 “Cor Loss” is within 1 mL of the “Expected Loss” for the ADA III.

“Pressure Corr. Recovery” - 5.0 is within 1 mL of the “Final Heat Adjustment Pt.” on the MP 626.

12.3 The test conditions specified in Attachment B must be met.

12.4 Toluene must be analyzed once a week during any week when analyses are performed and after any calibration of the temperature and volume measurement devices on either instrument.

The measured boiling point of Toluene at the 50% recovered point must be within 1 °C (1.8 °F) of 110.6 °C (231.1 °F) when analyzed under the conditions of ASTM Test Method D 1078.

A control chart (Form 109-02) is used to record the results for this standard.

Out-of-control indications must be investigated for cause.

Investigation results must be documented on the control chart.

12.5 The control gasoline and the control diesel fuel must be analyzed at a rate of one control fuel type for every 20 samples of that fuel type per instrument.

Individual control charts (Form 109-02) are used to record the results for these standards.

Out-of-control indications must be investigated for cause.

Investigation results must be documented on the control chart.

12.6 Laboratory duplicate range values must be within the control limits or an investigation for cause must be performed and reported.

The results of any investigation are documented on the control chart.

Reestablished process control must be demonstrated before further analyses can be performed.

13. Quality Provisions

13.1 Laboratory correlation, precision, and accuracy statistics will be reported by FCAB in an annual quality assurance report.

13.2 Repeatability for this procedure has been statistically determined using the control gasoline and the control diesel fuel.

The difference between two test results, obtained by the same operator with the same apparatus under constant operating conditions on identical test material, would, in the normal and current operations of the test method, exceed the following values only in one case out of 20:

Gasolines		ADA III	MP 626
	IBP	9.2 °F	Not Determined
	10% Evaporated	4.3 °F	Not Determined
	50% Evaporated	1.1 °F	Not Determined
	90% Evaporated	3.5 °F	Not Determined
	End Point	4.4 °F	Not Determined

#2 Diesel		ADA III	MP 626
	10 % Recovered	4.1 °F	3.8 °F
	50 % Recovered	1.1 °F	1.8 °F
	90 % Recovered	3.6 °F	1.6 °F

13.3 The accuracy of the instrumentation is verified by measurement of the boiling point of Toluene. The accuracy expressed as a 95 percent probability interval for 50 percent recovered temperature has been found to be:

	ADA III	MP 626
Toluene	110.5 ± 0.46 °C 230.9 ± 0.83 °F	110.6 ± 0.15 ° C 231.1 ± 0.27 ° F

13.4 The results of laboratory duplicates and quality control standard measurements are analyzed using statistical process control methods.

13.5 Validation of all analysis data is done by an independent technician.

13.6 Analysis samples sent to other facilities are resealed with a new Official Sample Seal, EPA Form 7500-2, and are shipped with Form 109-03 to assure sample integrity.

13.7 Samples are stored in conformance with FCAB Enforcement Sample Chain-of-Custody Procedure and the temperatures found in Attachment B.

Instrument Fuel Type Tally Sheet

Instrument: ____

Fuel Type	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	Date Control Fuel Analyzed

Form 115-01: 03-21-93

Operating and Test Conditions

Group	1	2	3	4
Group Characteristics:				
Vapor pressure at 100 °F, psi	≥ 9.5	< 9.5	<9.5	<9.5
Distillation, IBP °F	NA	NA	≤ 212	>212
EP °F	≤482	≤482	>482	>482
Sample Handling:				
Temperature of stored sample, °F	32-50	32-50	Ambient[1]	Ambient[1]
If sample is wet:	Resample	Resample	[2]	[2]
Apparatus test conditions:				
RTD setting	7F	7F	7F	8F
Flask Support hole diameter, inches	1.5	1.5	1.5	2.0
Initial test temperatures, °F:				
Flask and RTD	55-65	55-65	55-65	Ambient[1]
Flask support and shield	≤Ambient[1]	≤Ambient[1]	≤Ambient[1]	NA
Receiver and 100-mL sample	55-65	55-65	55-65	55-Ambient[1]
Condenser temperature, °F	32-34	32-40	32-40	70-140
Receiver temperature, °F	55-65	55-65	55-65	± 5 ° of charge
Times, seconds:				
From first heat to initial boiling point	300-600	300-600	300-600	300-900
From IBP to 5% recovered	60-75	60-75	NA	NA
From 5-mL residue to end point	180-300	180-300	300 max.	300 max.
Uniform average rate of condensation from 5% recovered to 5-mL residue [3], mL/min	4.0-5.0	4.0-5.0	4.0-5.0	4.0-5.0

1 For this procedure ambient temperature refers to normal room temperature and may be considered as 68 to 78 °F.

2 Free water may be removed by shaking the sample with anhydrous sodium sulfate and separating the agent from the sample by decanting.

3 The rate is calculated and reported for every 10 mL recovered. An acceptable test can have a single 10-mL increment with a condensation rate as low as 3.5 mL/min or as high as 5.5 mL/min. The remainder of the 10-mL increments must each have a condensation rate ≥ 4.0 mL/min., but ≤ 5.0 mL/min for a valid distillation.

Programs Available on FCAB Automatic Distillation Apparatus

Sample Type	ADAIII	MP 626
Diesel Control Fuel	Program 5	Diesel Control Fuel
Diesel Fuel	Program 6	Diesel Fuel
Toluene	Program 7	Toluene
Hexadecane	Program 8	Hexadecane
Gasoline with RVP< 9.5 psi	Program 4	Summer Gasoline
Gasoline with RVP> 9.5 psi	Program 1	Winter Gasoline
Control Gasoline	Program 3	Control Gasoline

Distillation Program Modification Guidelines

ADA III:

Program selection and the adjustment of "Initial Heat," "5 Minute Heat," "Incr Final Heat," and "Expected Loss" are the only operator adjustments available on the ADA III to achieve the specified test conditions. Heating values are given in watts.

The "Initial Heat" is determined by the fuel type and its volatility. It is best estimated by the selection of the appropriate program from Attachment C.

Usually, the heat input that provides a uniform distillation rate of 4 to 5 mL/min between the 10% and 20% recovered points provide the best estimate for the "5 Minute Heat."

The "Incr Final Heat" is adjusted to achieve the specified time from 5 mL residue to end point. The interaction of the "Expected Loss" and "Incr Final Heat" is crucial and may require multiple tests to achieve an in-specification distillation. The greater the "Expected Loss" the sooner in the distillation the "Incr Final Heat" will be applied to the sample. Conversely the lower the "Expected Loss" the later in the distillation the "Incr Final Heat" will be applied to the sample. The nature of the material in the 5-mL residue, and the specified time from 5-mL residue to end point specified in Attachment B, governs the value needed for "Incr Final Heat."

The "Expected Loss" is usually, but not always, 2.0% for summer gasolines, 4.0% for winter gasolines, and 1.0% for fuel oils. Once a distillation has been performed on a sample, a better estimate of "Expected Loss" may be made for subsequent distillations by reviewing the actual observed loss.

MP 626:

Program selection and adjustment of the "Initial Heat Temp. 1," "Initial Heat Temp. 2," "After Initial Heat," "Final heat adjustment pt.," "Final heat adjustment by," and "Follow the heat curve" are the only operator adjustments available on the MP 626 to achieve the specified test conditions. Heating values are in °F, except the "Final heat adjustment by," which is percent change of the instrument set rate just before reaching the "Final heat adjustment pt.."

"Initial Heat Temp. 1" is determined by the fuel type and its volatility. It is best estimated by selection of the appropriate program found in Attachment C.

"After Initial Heat" is usually set at 4 minutes on the MP 626 but can be changed and used in an interactive manner with the "Initial Heat Temp. 1" and "Initial Heat Temp. 2" to achieve the specified time to the initial boiling point.

Usually, but not always, the heat input that provides a uniform distillation rate of 4 to 5 mL/min between the 10% and 20% recovered points provide the best estimate for “Initial Heat Temp. 2.”

“Final heat adjustment pt.” is usually, but not always, 93.0% for summer gasolines, 91.0% for winter gasolines, and 94.0% for fuel oils. Once a distillation has been performed on a sample, a better estimate of “Final heat adjustment pt” may be made for subsequent distillations by reviewing the actual observed loss.

“Final heat adjustment by” is modified to achieve the specified time from 5 mL residue to end point. The interaction of the “Final heat adjustment pt.” and “Final heat adjustment by” is crucial and may require multiple tests to achieve an in-specification distillation. The lower the “Final heat adjustment pt.,” the sooner in the distillation the “Final heat adjustment by” will be applied to the sample. Conversely the higher the “Final heat adjustment pt.” the later in the distillation the “Final heat adjustment by” will be applied to the sample. The nature of the material in the 5-mL residue and the specified time from 5-mL residue to end point specified in Attachment B governs the value needed for “Final heat adjustment by.”

“Follow the heat curve” is an option for fuels that the MP 626 has problems controlling the distillation rate anywhere between the 5% recovered and the “Final heat adjustment pt.” The inputs to control this feature are done through the graphic software package and is activated by a “Yes” or “No” during the instrument’s programing. Refer to the operator’s manual for details regarding this option.

ADA III Output

ASTM: D86, Group 1
Product: Gasoline, regular

Program	5
Temperature Range:	32-572°F (0-300°C)
Distillation Rate:	4.5 ml/min.
Condenser Temperature:	0-1°C
Receiving Chamber:	13-18°C (door closed, auto temp)
Sample Initial Temp.:	13-18°C
Flask:	125 ml.
Initial RTD Vapor Sensor Temp.:	13-18°C (pre-cool through panel hole)
Distillation Board:	(Hole dia.) 1-1/2 inches
Drop Guide:	not required
Initial Heat:	130 W
5 Min. Heat:	280 W
Incr. Final Ht:	+100 W
Expected Loss:	1.0%

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OPERATOR:.....
JUL 15 1988 07:23
UNIT ID NUMBER    05
TESTING   CONDITIONS

SAMPLE
CHAMBER   TEMP=15.6C
CONDENSER TEMP=00.2C
BAROMETER  = 746mmHg
PROGRAM  5
TEMP RANGE    32-572F
DIST RATE  4.5ML/MIN
INITIAL HEAT     130W
5 MINUTE HEAT    280W
INCR FINAL HT    100W
EXPECTED LOSS    1.0%
END AT END POINT
IBP LIMITS 5M TO 10M

DISTILLATION RESULTS
TEMPERATURES ARE
CORRECTED TO 760mmHg
IBP    89.6F   7.2 MIN
  5ML 112.2F    74 SEC
 10ML 125.7F   4.4ML/M
 20ML 150.0F   4.2ML/M
 30ML 175.1F   4.4ML/M
 40ML 202.1F   4.3ML/M
 50ML 229.0F   4.4ML/M
 60ML 254.4F   4.3ML/M
 70ML 279.5F   4.3ML/M
 80ML 307.9F   4.2ML/M
 90ML 343.5F   4.2ML/M
 93.0ML 365.3F      FH
FH  WATTAGE  =  570W
 95.0ML 384.6F
 97.0ML 423.5F END PT
1.5MIN FROM FH TO EP
  97.3ML      RECOVERY
   1.2ML       RESIDUE
  98.5ML TOT RECOVERY
   1.5ML           LOSS


TEMPERATURES VS
EVAPORATED SAMPLE
IBP          89.6F
  5ML       107.7F
 10ML       128.0F
 20ML       146.0F
 30ML       171.5F
 40ML       197.9F
 50ML       225.0F
 60ML       250.0F
 70ML       275.5F
 80ML       303.4F
 90ML       338.1F
 95ML       369.6F
 98.5ML     420.8F  EP
  1.3ML       COR LOSS
  1.2ML        RESIDUE
 97.5ML COR RECOVERY
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H E R Z O G MP 626 Version : 4.05

Unit no. : 1 15:42:23 02.11.1993

Sample number : 12
Sample description :

Program number : GASOLINE*

Distill. Standard : ASTM D 86-1
Distill. Group : 1 Distill.Thermometer : 7F

Condenser Temperat. : 32 °F Initial Heat Temp.1: 226 °F
Receiver Temperat. : 60 °F Initial Heat Temp.2: 702 °F
Distillation Rate : 4.5 ml/min After Initial Heat : 3 min

FBP detect : 2 °F Final heat adjustment pt.: 91 %
Distillation Termin.: FBP Final heat adjustment by : 0 %
Follow the heat curve : OFF

Volume Vol %	Dist.Rate ml/min	Thermo.reading °F	Pressure Corr. °F	Evaporat. Corr. °F
IBP	340.2 sec	80.4	81.3	81.3
5	74.6 sec	99.0	100.0	93.4
10	4.0	109.4	110.4	106.2
20	4.2	129.6	130.6	126.2
30	4.3	152.6	153.6	148.0
40	4.4	177.1	178.2	173.1
50	4.4	204.1	205.2	199.7
60	4.5	230.0	231.2	225.9
70	4.3	256.3	257.5	251.8
80	4.1	290.5	291.8	283.6
90	4.0	331.0	332.4	324.2
95	74.0 sec	376.0	377.4	353.7
DP				
FBP	140.0 sec	397.4	398.9	398.9

Recovery : 96.5 Vol % 96.9 Vol %
Distill. Loss : 2.5 ml 2.1 ml
Distill. Residue : 1.0 ml
Atm Pressure : 746 mmHg